Workshop on Bioinformatics & Assay Development for Homeland Security

Assays and Bioinformatics Overview

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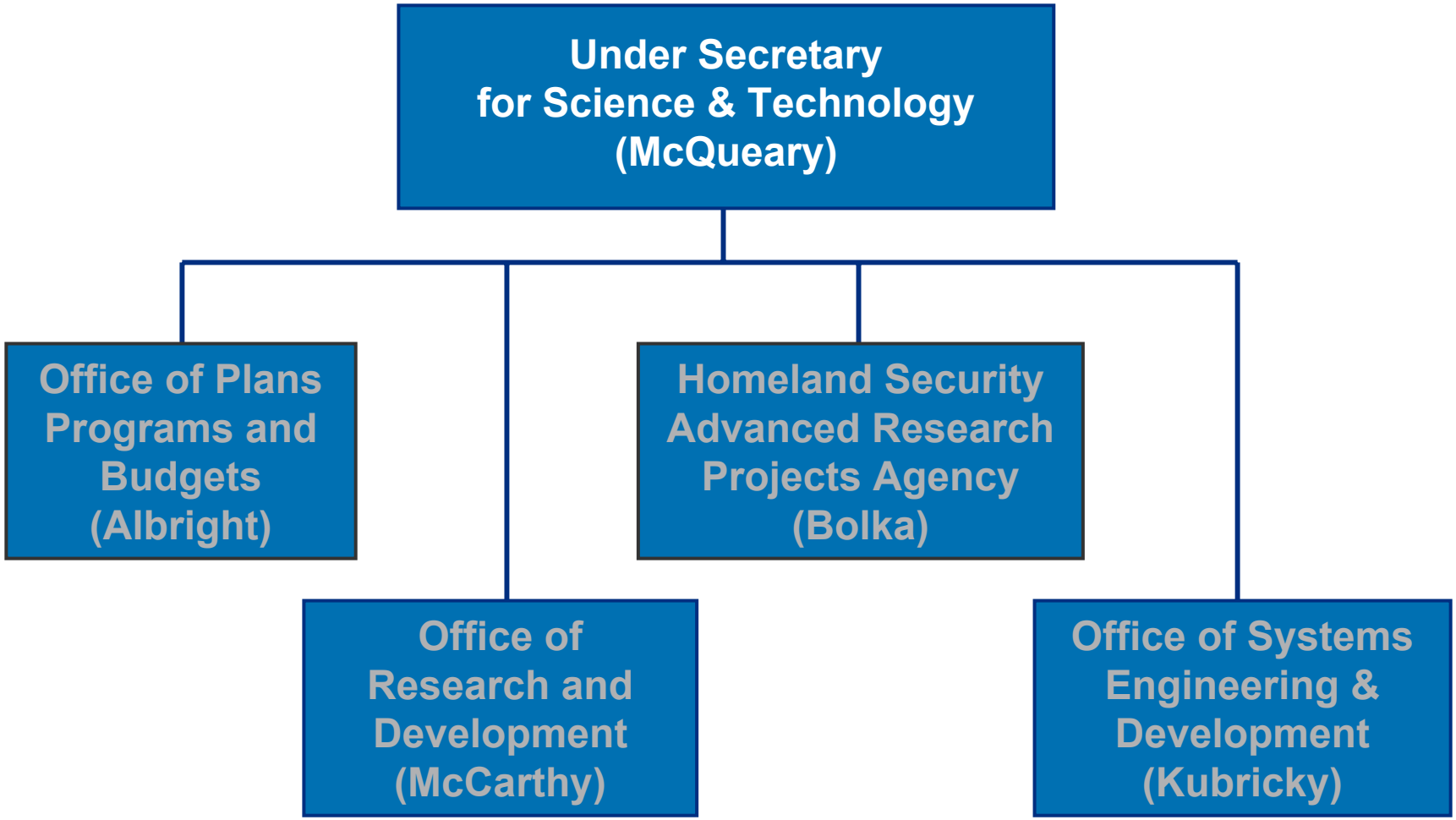
S&T Organization Chart



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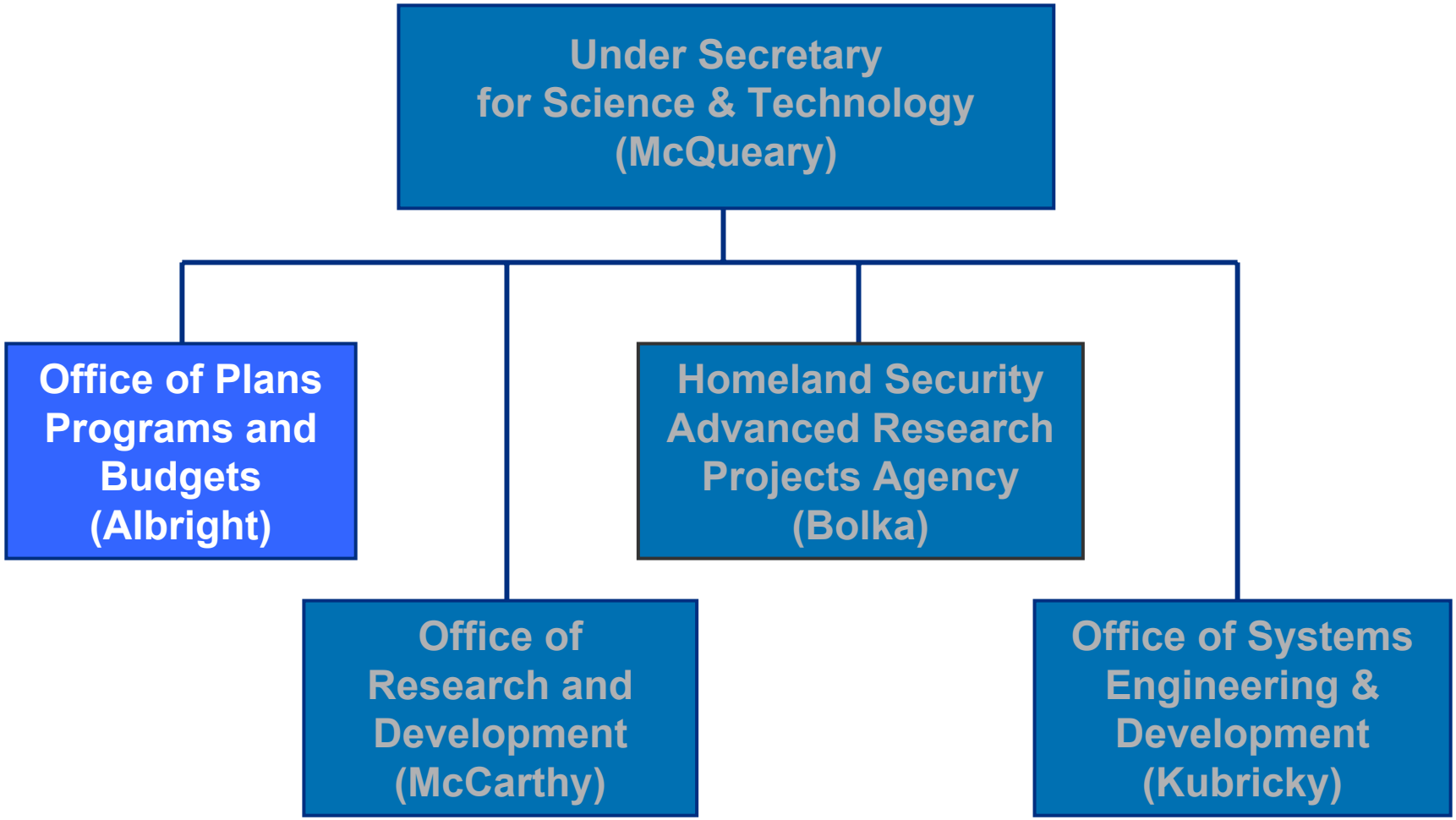

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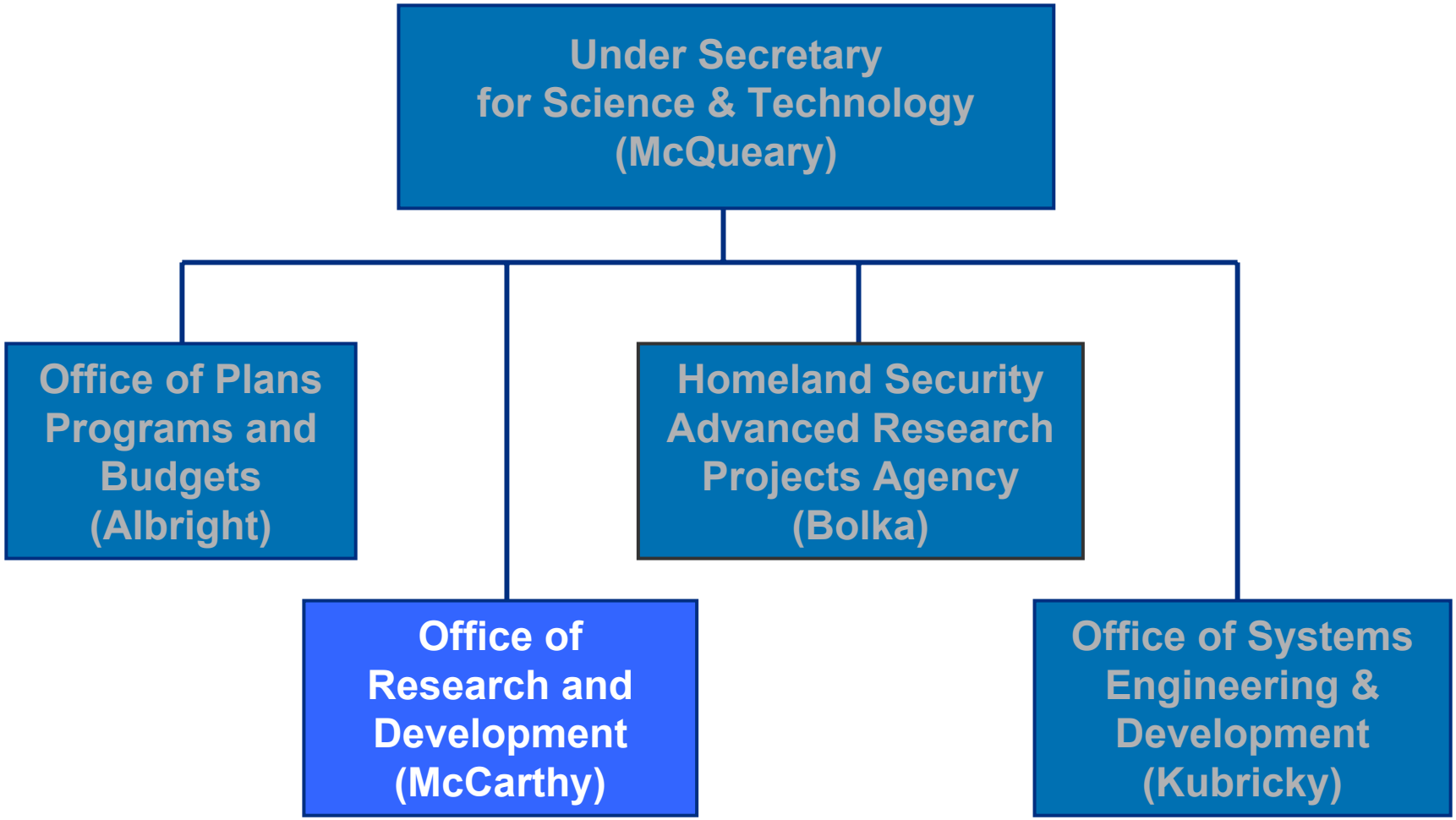

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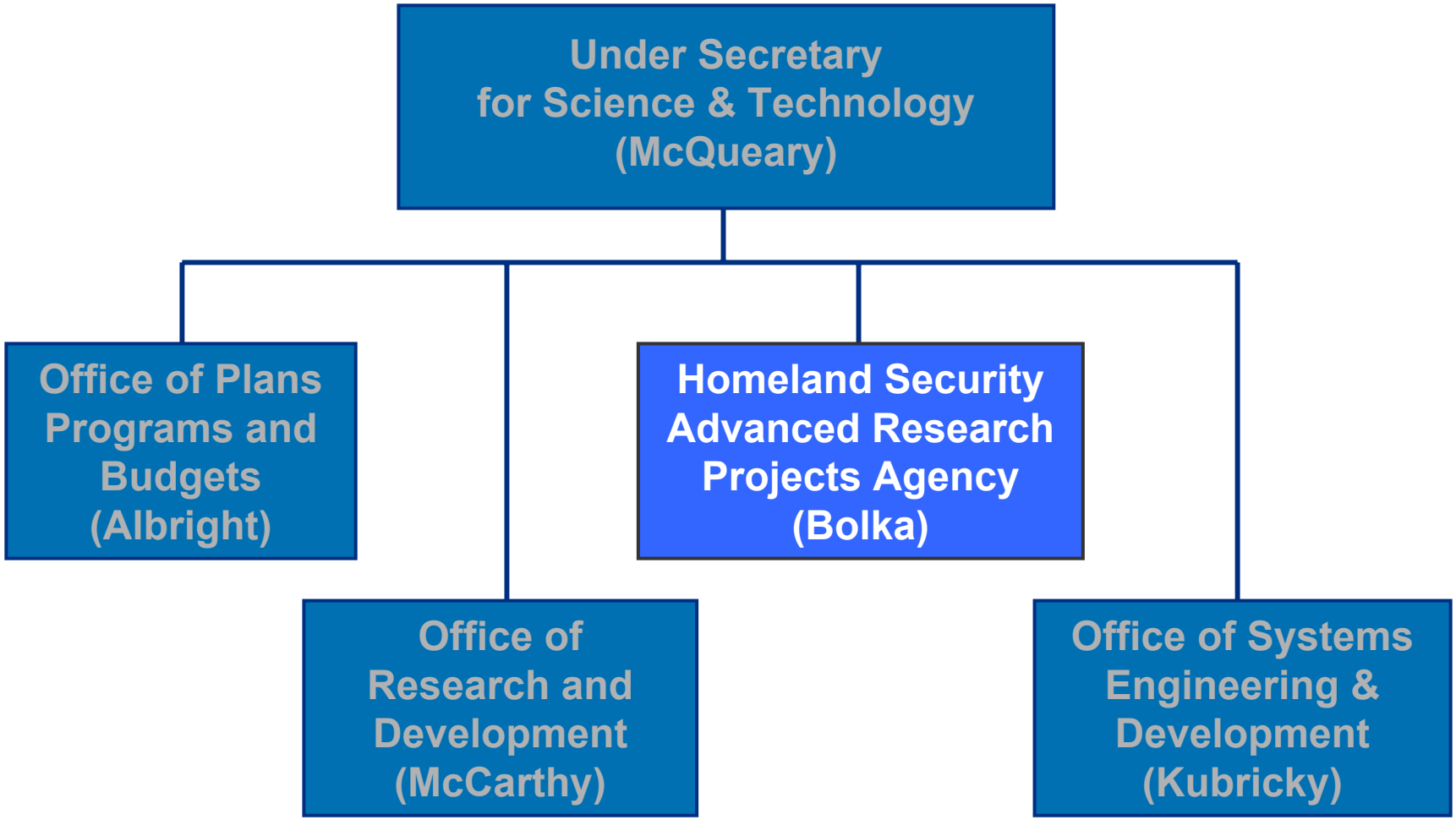

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Today's presentations are provided by researchers from:

- DoE/DHS National Laboratories
- DHS Laboratories
- Academic Laboratories
- Private sector businesses

All aim to give you some indication of:

Current state of the art
Future plan
New ideas

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RA 03-01: Detection Systems for Biological and Chemical Countermeasures

Solicitation announced: **25 September** White papers due: **24 October**
Full proposals due: **19 December** Reviews Completed: **15 January**

Awardees selected late January and announced in Jan-Feb

- TTA-1: Bioagent Autonomous Networked Detectors (BAND)
- TTA-2: Rapid Automated Biological Identification System (RABIS)
- TTA-3: Autonomous Rapid Facility Chemical Agent Monitor (ARFCAM)
- TTA-4: Lightweight Autonomous Chemical Identification System (LACIS)
- TTA-5: Portable High-throughput Integrated Laboratory Identification System (PHILIS)

These use best existing methods to address limitations of our current Homeland Security Sensors

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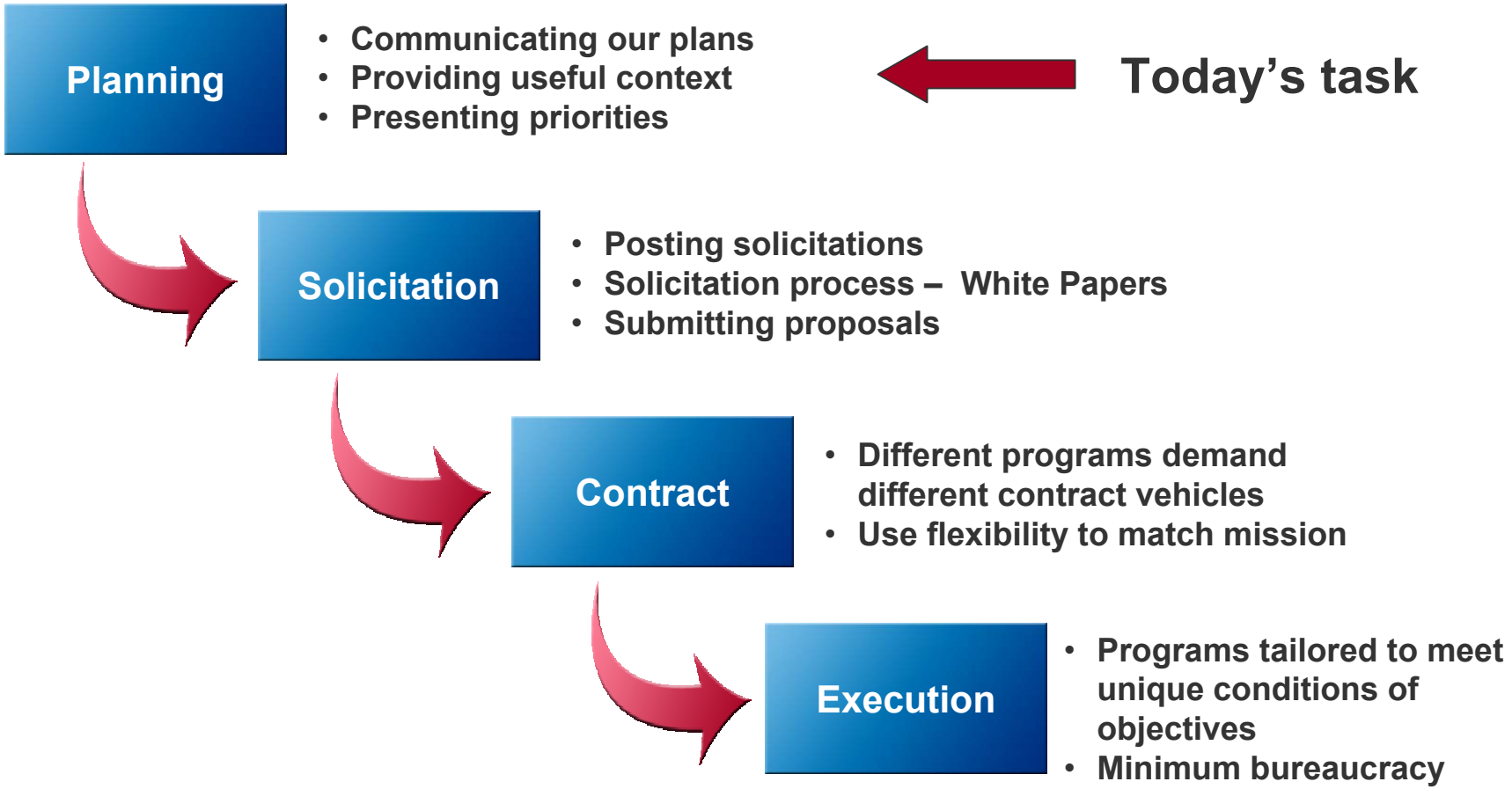
HSARPA plans a new solicitation for Bioinformatics and Assays to better address future requirements



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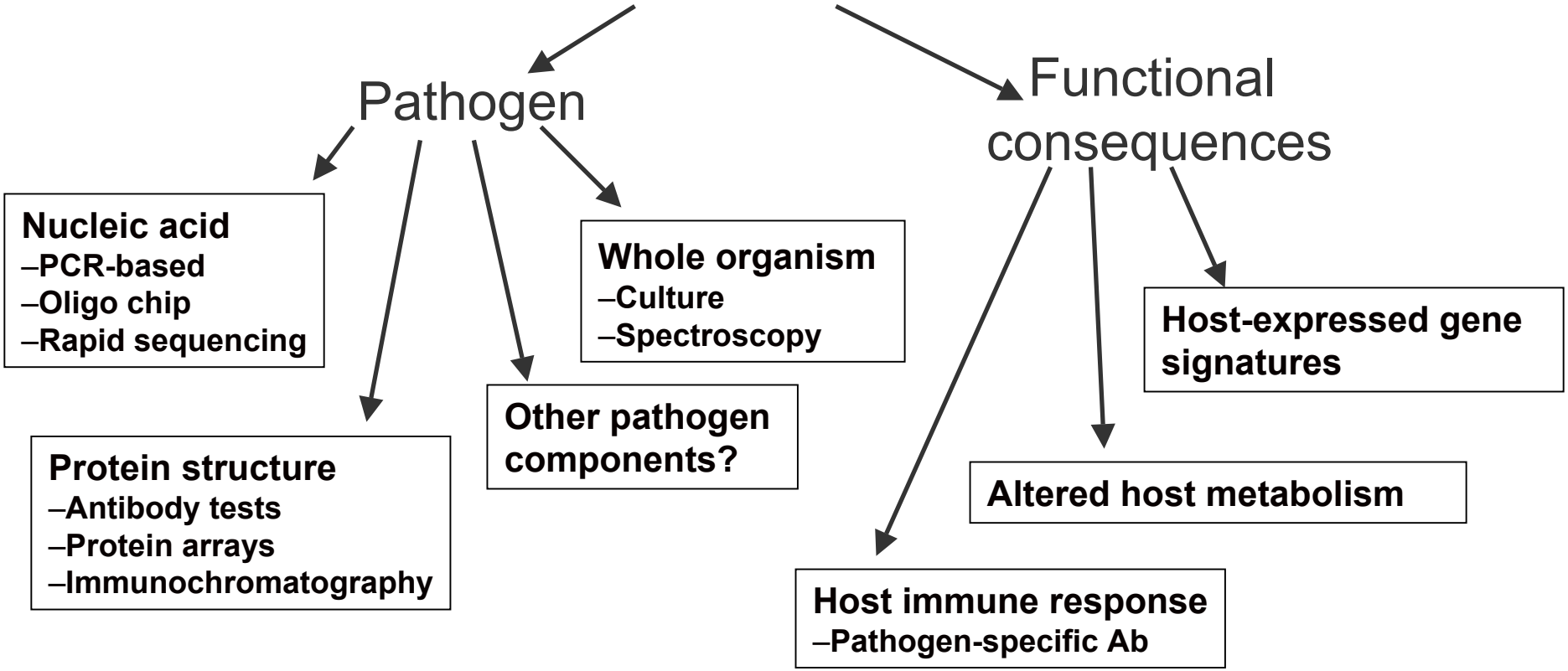
Assays for Bio-threats

DETECTION for Warning, Treating, Attribution



Some Limitations of Current Assay Technologies

- Requires prior detailed information about pathogen(s)
- Requires development of pathogen-specific reagents
  - Expensive and often not “generalizable”
- **New threats** require lead-time to develop knowledge about pathogen and new reagents
- May be susceptible to “spoofing”, threat avoids displaying assay-specific targets
- Response times or sensitivities not suitable for all Concepts of Operations
- Technical limits to multiplexing, since requirement is often for detection of a large number of threats simultaneously.

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Some Technical Challenges for Novel Assays for Homeland Security Applications

- Can **sensitivity – selectivity** tradeoffs that characterize current methods be overcome ?
- How best can we address **new threats** rapidly and effectively ?
- Can sensitivity and selectivity be tuned to achieve l**ow false positive rates** required for civilian (*vice* DoD) applications ?
- Can **response time of detectors** be enhanced to provide “Detect to warn” as well as “Detect to treat” capability?
- Can engineering simplicity and economy of scale be achieved to provide **low target costs** for homeland security applications ?

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Bioinformatics Overview

- Can informatics guide the development of assays?
  - Nucleic acid & protein assays?
  - Novel assays?
- Do we target species of pathogens or can we directly target pathogenicity?
- How do we handle unknown and engineered threats?
- Can we simultaneously detect and characterize ? How does forensics fit?
- Can we extend baseline assay knowledge to novel approaches?
  - How much is extendable, how much must be invented ?
- What is the minimum knowledge set DHS should make available to DHS performers and PIs?
  - Databases, simulants, threats, standardized backgrounds?

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Bioinformatics and Detection

- What are the formats for assay exploitation?
  - Standardized formats vs. novel approaches?
- How best can we handle the background?
  - What is the background? What causes false alarms?
- Can we model the performance of assays and detectors?
  - Can this modeling be used to guide detector development?
- How do we validate assays?
  - What does it mean to have orthogonal assays?
- How do we validate systems of detectors and assays?
  - How do we establish confidence levels, and standards?

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Possible Theme Areas for a Future Solicitation

- Extension of baseline protein and nucleic acid assays
  - Extensions to novel approaches for assays
- Approaches to assays for new and engineered threats
  - Direct detection of pathogenicity
  - Universal assays
  - Rapid turn-around development time
- Characterization of the background
- Bioinformatics tools for assay development and understanding
  - Databases and computational tools
  - Predictive performance tools for complete systems
- Assays and tools for forensic analysis

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